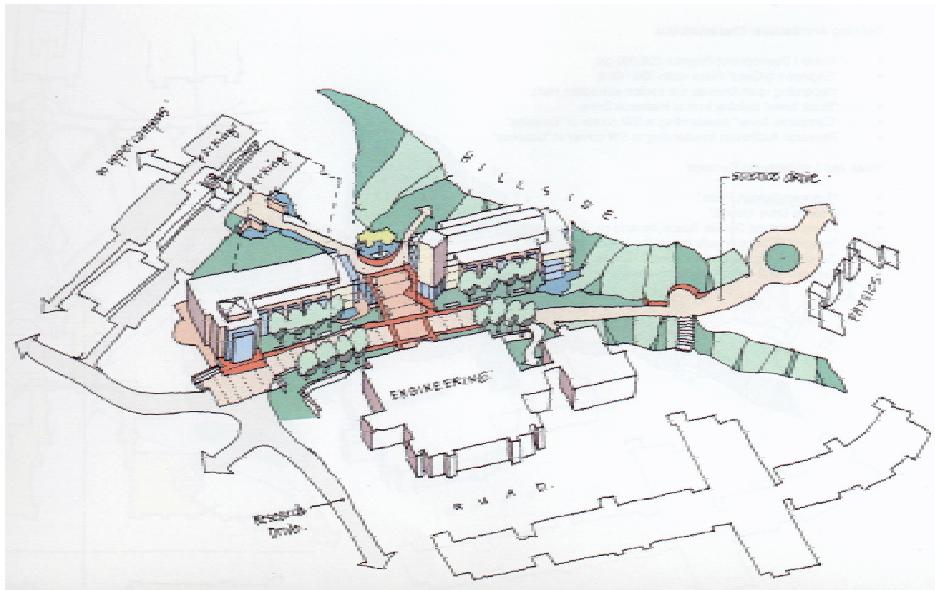


Fitzpatrick Center for Photonics and Communication Systems

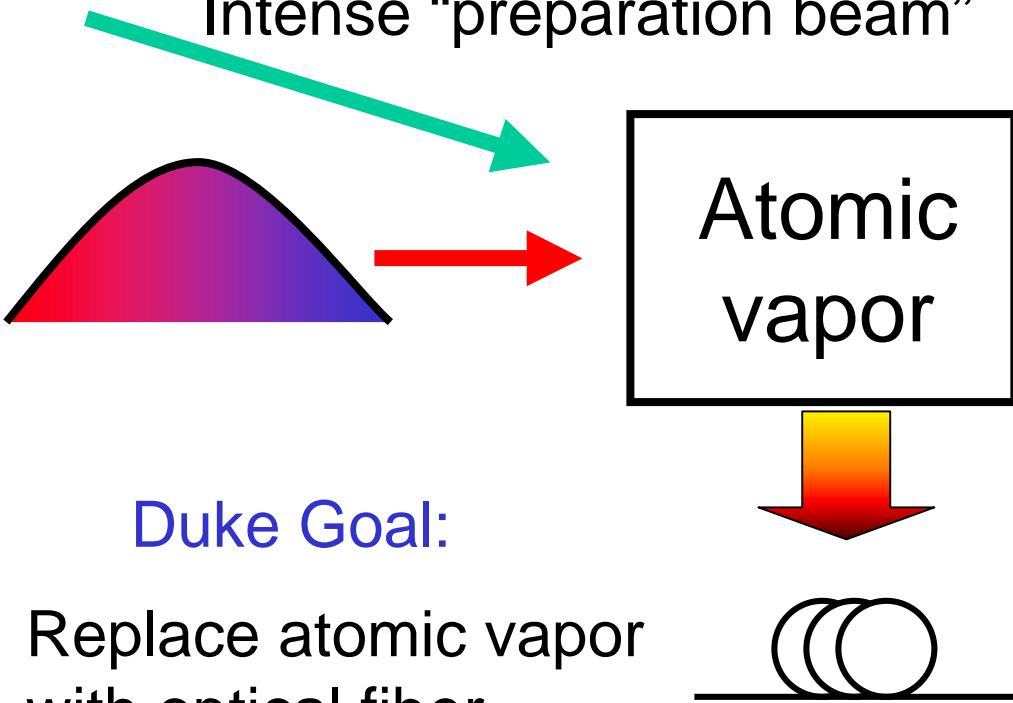
Programs

- The Optical Networks Laboratory (S. Radic, K. Trivedi, Q. Liu)
- The Quantum Optoelectronics Laboratory (D. Gauthier, J. Thomas)
- The Information Spaces Laboratory (D. Brady, J. Board, S. Cummer)
- The Optoelectronic Devices and Systems Laboratory
(A. Brown, H. Massoud, H. Everitt, K. Johnson)
- The Biophotonics Laboratory (J. Izatt, A. Wax)



Optical Buffering

Dynamic Optical Dispersion Management: Slow Light
Intense “preparation beam”



Slow light:
 $V_g < 10 \text{ m/s}!$

- atomic resonance required
- narrow-band operation
- long pulses

Duke Goal:

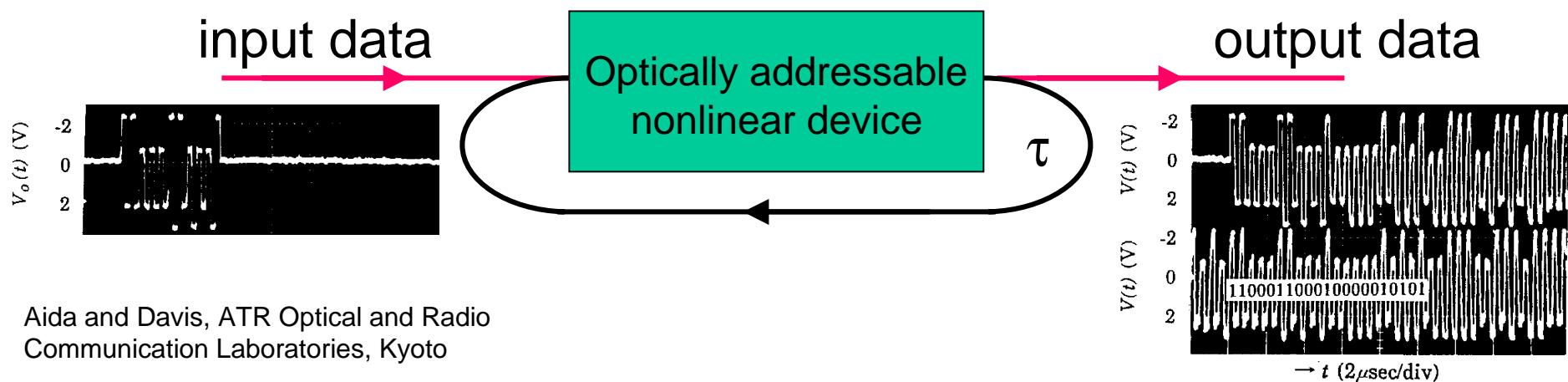
Replace atomic vapor
with optical fiber

Use nonlinear optical
parametric wave mixing or
Brillouin selective sideband
generation to create
desired dispersion

Will allow for arbitrary, real-time management of complete
dispersion of channel by tailoring the “preparation beam”

Optical Buffering

Advanced Optical Data Buffers: Dynamic Optical Memory Using Nonlinear Time-Delay Devices



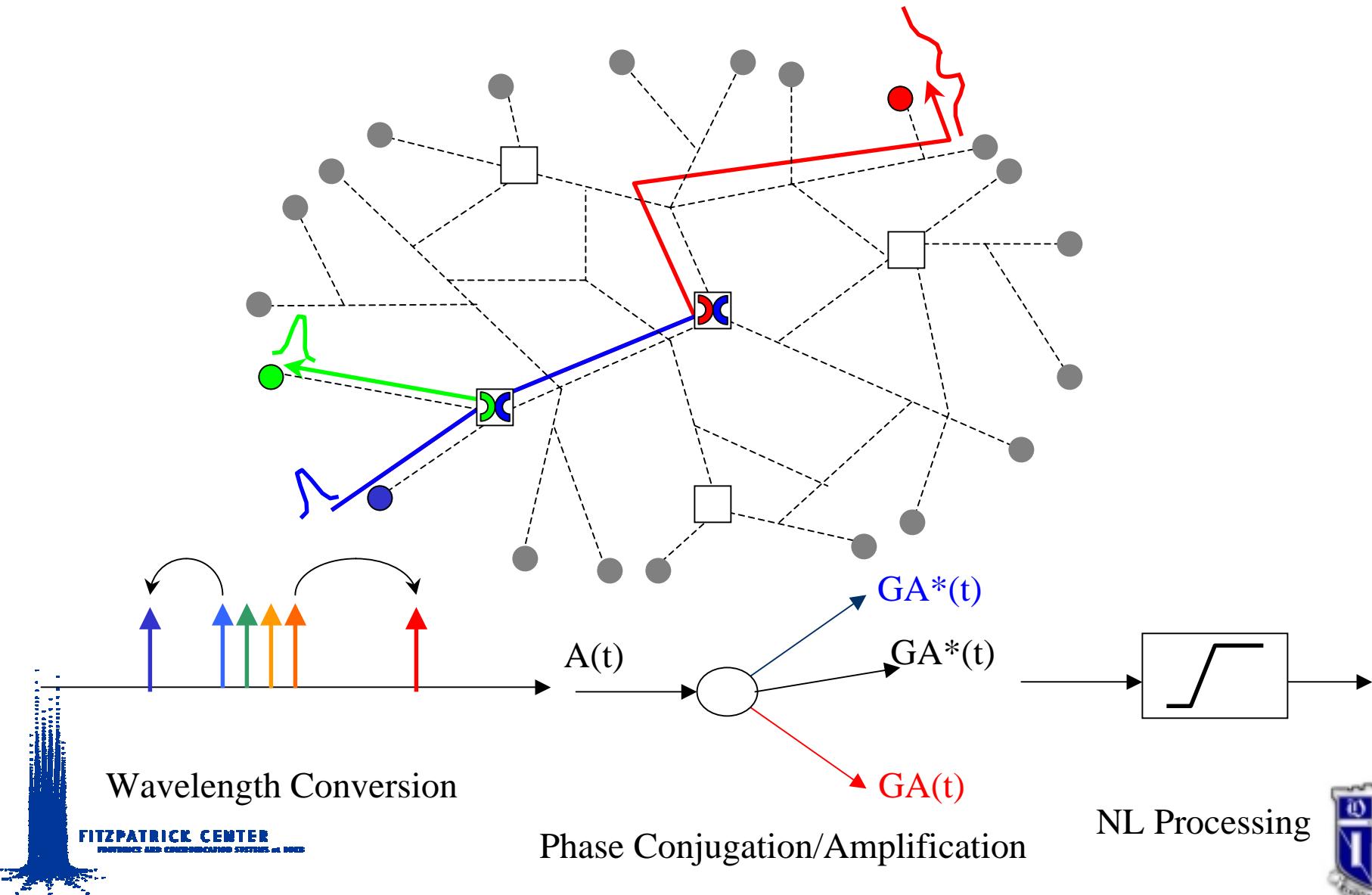
Aida and Davis, ATR Optical and Radio
Communication Laboratories, Kyoto

- Nonlinear devices are sensitive to input perturbations, latches to weak input data (bias below transition to chaos)
- Time-delay τ sets code repeat time, storage $>> 10^6 \tau$

Duke Goals:

- All optical implementation using near-deployable components
- Operate at 40 Gb/s standard
- Assess robustness

Arbitrary Wavelength Assignment, Variable Signal Integrity



Wavelength Conversion

FITZPATRICK CENTER
PHOTONIC AND COMMUNICATING SYSTEMS AT ROME

Phase Conjugation/Amplification

NL Processing



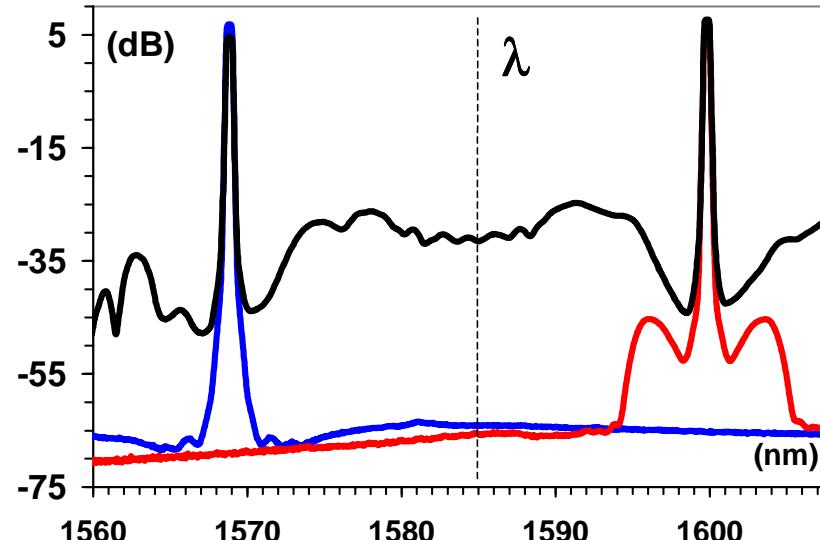
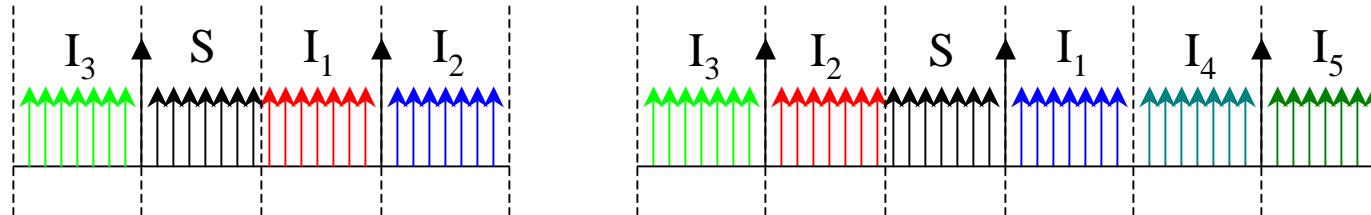
Parametric Processing

- 1 Noiseless Signal Regeneration
- 2 Amplification **anywhere** within the spectra
- 3 Multiple, Equalized wave band conversion.
- 4 **WDM** Signal Conjugation: Penalty Reversal
- 5 Fast (Packet) Switching/Routing
- 6 Signal Regeneration

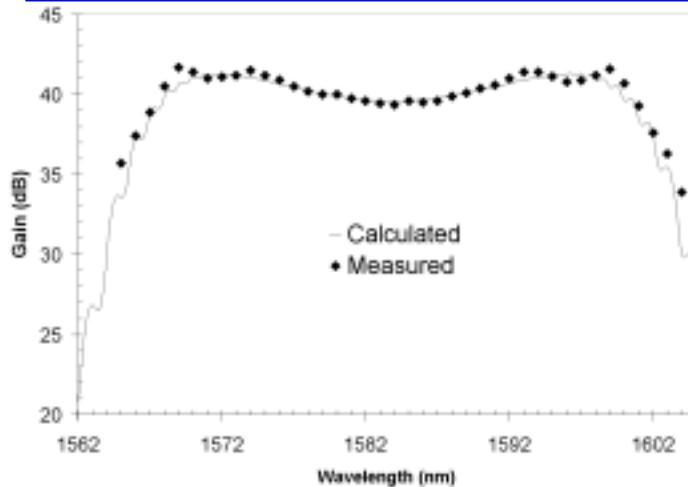
Platforms: Semiconductor/PPLN/**High Confinement Fiber**

Material	γ (1/km/W)
SiO ₂ /Ge	20
Bi ₂ O ₃	64
As ₂ S ₃	162
SF57(PBF)	550

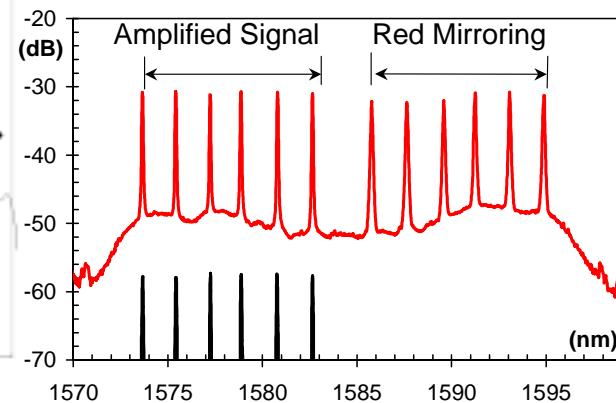
Multiple Pumps: Modulational Coupling



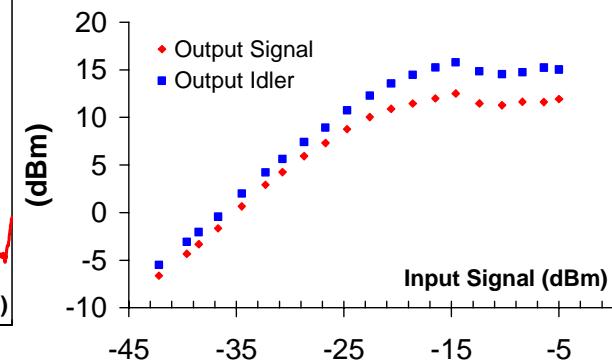
Parametric Processing



Record equalized gain

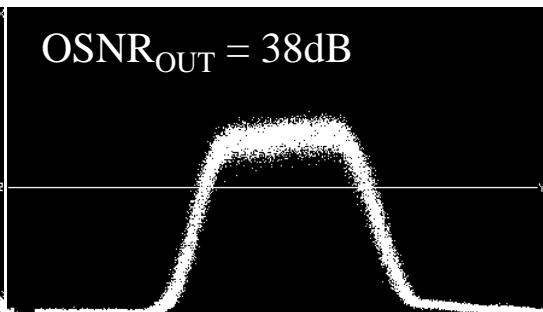
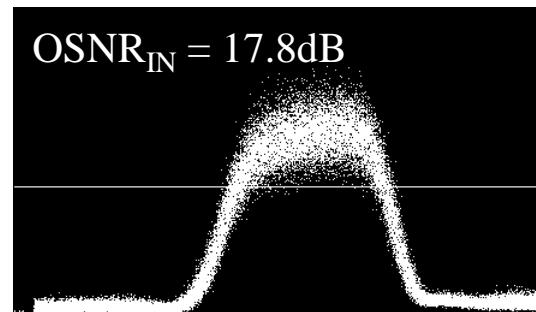


Waveband Mapping



Conversion Record

Regeneration > 20dB



**Polarization Invariant
Multiple Channel
Asymmetric
Spectral Inversion**

